FOREST PRODUCTS
Project Fact Sheet

WHAT CAUSES THE "DENSITY EFFECT" IN YOUNG FOREST PLANTATIONS

BENEFITS

- Advances in fundamental knowledge
- Increase in productivity for many years
- Use of proven tree densities for maximum cost efficiency
- Stimulation of additional research among plant biologists

APPLICATIONS

Evidence for either hypothesis being tested will provide many opportunities for commercial growers to manipulate young plantations to achieve maximum growth.

Study Will Clarify Formation Research to Change Fundamental Views on Young Forest Communities

The forestry industry would like to take advantage of a phenomenon known as the "density effect" to increase plantation yields. This effect has been observed in managed forests, in which seedlings planted at high densities grow more rapidly in height and density than those planted farther apart. It is known to last a few years in young plantations of both coniferous and hardwood species, but in order to exploit the phenomenon, the forestry industry needs to better understand its mechanism. Researchers have proposed two possible hypotheses as the basis for the density effect, and each will be tested on sites owned by the Weyerhaeuser Company.

Although Weyerhaeuser has recognized the density effect and increased planting densities in many of its plantations, the forestry industry will obtain more precise information for prescribing densities.

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ENERGY EFFICIENCY AND RENEWABLE ENERGY • U.S. DEPARTMENT OF ENERGY

PROJECT DESCRIPTION

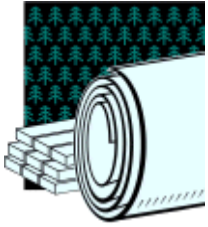
Goal: To test two hypotheses as possible explanations for the "density effect" in order to obtain more precise information about this growth phenomenon in tree plantations.

The first hypothesis suggests that young trees can "sense" neighboring trees through an alteration in the ratio of red:far-red light (R:FR) reflected from their foliage, and that they adjust their growth rate to surpass future competitors for light and air. The second hypothesis states that there is an atmospheric "boundary layer" around high-density plantings where respired CO2 and transpired H2O vapor are trapped, and the presence of these gases increases the net photosynthesis that takes place in the area.

In addition to sites planted by Weyerhaeuser at variable tree densities, researchers will have access to the company's preliminary data on the density effect from research conducted over several years.

PROGRESS & MILESTONES

- Studies will be conducted at Weyerhaeuser Company's 130 test plantations in western Washington State, planted at densities of 150, 500, and 1200 trees/acre.
- The first hypothesis will be tested by determining whether light quality impacts photosynthesis and/or altered patterns of carbon allocation above and below ground.
- Measurements will be made of the R:FR signals for various tree densities and ages followed by chlorophyll fluorometry to detect any correlation of the R:FR signal with changes in photosynthesis.
- IFor the second hypothesis, a simple model will be developed to estimate how the canopy atmosphere affects net daily photosynthesis at different tree densities.
- These studies will include examining the ratios of the stable isotopes of carbon and oxygen in the trees' annual growth rings, since these elements are components of wood cellulose.
- Predictions are that high-density trees will have relatively low ratios of 13C/12C and of 18O/16O isotopes in their wood cellulose because of known physiological processes.
- There will also be direct measurement of gas concentrations in atmospheric profiles.



PROJECT PARTNERS
Oregon State University
Corvallis, OH

Weyerhaeuser Company
Centralia, WA

University of Utah
Salt Lake City, UT

FOR ADDITIONAL INFORMATION PLEASE CONTACT:

Ingrid Watson
Office of Industrial Technologies
Phone: (202) 586-8119
Fax: (202) 586-1658
e-mail: ingrid.watson@ee.doe.gov

Dr. Barbara J. Yoder
Oregon State University
Phone: (541) 737-6110
Fax: (541) 737-5814
e-mail: yoderb@ccmail.orst.edu

Please send any comments, questions, or suggestions to webmaster.oit@ee.doe.gov

Office of Industrial Technologies
Energy Efficiency and Renewable Energy
U.S. Department of Energy
Washington, D.C. 20585

September 1998